similar to those which have appeared annually since 1868. Two decades of continuous and uniform labor, of the excellent quality shown by New York's official botanist, is a record of which to be proud.

Both these reports, like two of the preceding, have the plates in quarto form, but they may be once folded and conveniently bound with the text in an octavo volume. An innovation is introduced with the last report by having it issued in the series of *Bulletins* of the Museum, instead of being part of the *Annual Report*, as heretofore.

Each report contains notes upon a large number of species of flowering and cryptogramic plants of the state of New York, in part recorded for the first time as occurring within its limits. In the 1897 report twenty-five species of fungi are described as new, and six species in the 1898 report. The detailed account of edible fungi, with colored illustrations, is continued, twenty-three species being added in these reports. In the last report there is also an account of the plants on the summit of Mt. Marcy, whose height is 5344 feet.— J. C. A.

THE VOLUME of biological lectures given at the Woods Hole Biological Laboratory in 1898[10] contains addresses of zoological interest chiefly. Some of the sixteen lectures treat large problems, and therefore deserve the attention of botanists, though the treatment is strictly from the zoological standpoint. The address by E. B. Wilson on the structure of protoplasm, that by S. Watasé on protoplasmic contractility and phosphorescence, and that by T. H. Montgomery on various nucleolar structures of the cell may be named as of most general interest. The volume should be indexed.

THE ELEVENTH annual report of the director of the Missouri Botanical Garden has been issued.[11] Extracts of the most general interest have already been given. The scientific papers include H. von Schrenk's paper on an important disease of cypress timber and a similar disease in the wood of the genetically related Libocedrus; J. N. Rose's description of the four agaves which flowered in Washington in 1898, including a new species, *A. expatriata;* J. B. S. Norton's monograph of the North American euphorbias of the Tithymalus group, amounting to nearly forty species, and several new varieties, all of them figured on good plates; and J. G. Smith's revision of the half dozen United States Species of Lophotocarpus, together with a description of a new species of Sagittaria, *S. Eatoni.* The volume needs an index.

NOTES FOR STUDENTS.

EXPERIMENT STATION BULLETINS dealing with plant diseases, not heretofore mentioned in these pages, are as follows: A. P. Anderson (S. C. no. 41 : 3–14. *4 figs.*) describes "Rice blast and a new smut on the rice plant,"

[10] 8vo. pp. iv + 343, illust. Boston: Ginn & Co. 1899.

[11] 8vo. pp. 151, *pl. 58.*

the cause or causes of the first trouble being conjectured, and that of the second being identified as *Tilletia corona* Scrib.; while Ernest Walker in the same bulletin (p. 15–31, *1 fig.*) discusses "Treatment for rice smut," showing by tests that a number of fungicidal methods are available, but owing to failure in germinating the smut spores their efficiency was not determined. A. B. Cordley (Ore. no. 57 : 3–15. *1 pl. 7 figs.*) gives an account, under the title "Brown rot," of the injury to fruit in Oregon, due to *Monilia fructigena* Pers., together with a study of the fungus. H. H. Lamson (N. H. no. 65 : 99–108. *6 figs.*) gives "Notes on apple and potato diseases in 1898," with tests of fungicides. A. D. Selby (Ohio no. 97 : 31–61. *4 figs.*) presents considerable data upon smut, rust and scab of wheat and smut of oats. The Fusarium causing wheat scab has been traced to an ascigerous condition, believed to be identical with *Gibberella Saubinettii* Sacc. Results of treatment of seed grain to prevent the several smuts, J. F. Hickman being associated with this part of the work, are tabulated. A. D. Selby (Ohio no. 104 : 201–216. *3. pl.*) also shows the beneficial results obtained by spraying for peach curl, and gives a few notes on crown gall and yellows of peach. The same investigator (Ohio no. 105 : 217–235. *2 figs.*) publishes "Further studies of cucumber, melon and tomato diseases," with some account of the fungous and bacterial causes, and the results of spraying. F. A. Sirrine and F. C. Stewart (N. Y. no. 156 : 375–396. *4 pl.*) cover part of the same ground with statistics on "Spraying cucumbers in the season of 1898." A popular description of "The black rust or summer rust" of grains is given by Otto Lugger (Minn. no. 64 : 535–550. *13 figs.*) Methods for "The prevention of the smuts of cereal grains, and prevention of potato scab" are presented by H. L. Bolley (N. D. no. 37 : 363–379. *3 figs.*) with some results attained by farmers. H. Garman (Ky. no. 81 : 3–11. *2 pl. 1 fig.*) tells of "A method of avoiding lettuce rot" under glass by employing a system of sub-watering, and also gives the results of "Potato scab experiments made in 1898" in the use of fungicides. A. P. Anderson (S. C. no. 38 : 3–15. *5 figs.*) writes on "The asparagus rust in South Carolina," and G. E. Stone and R. E. Smith (Hatch, Mass. no. 61 : 3–20. *2 pl.*) write on "The asparagus rust in Massachusetts." J. C. Blair (Ill. no. 54 : 181–204. *27 figs.*) gives directions for "Spraying apple trees with special reference to apple scab fungus;" S. T. Maynard (Hatch, Mass. no. 60 : 3–11) provides formulæ for "Insecticides, fungicides," accompanied by a "Spraying calendar;" while W. M. Munson (Me. no. 52 . 3–8) gives general directions and formulæ for "The spraying of plants." A. L. Quaintance (Fla. no. 46 : 77–114. *12 figs.*) provides a rather full account of the strawberry thrips (*Thrips Tritici* Osb.) and of the onion thrips (*Thrips Tabaci* Lind,). and of the nature of the injuries they cause to plants. G. E. Stone and R. E. Smith (Hatch, Mass. no. 55 : 3–67. *12 pl.*) give a large amount of information about "Nematode worms" (*Hederodera radicola* Müll.), including historical and experimental data, much of it new, and with

illustrations showing the development of the worms and the production of galls on the plants. C. P. Close (N. Y. no. 161 : 153–164. *2 pl.*) records three season's tests in successfully combating gooseberry mildew with potassium sulfid, and less important results with Bordeaux mixture, lysol, and formalin. A popular two-page edition of this bulletin has been prepared by F. H. Hall.— J. C. A.

ANNUAL REPORTS of experiment stations published during the year 1899 not yet mentioned in these pages but containing matters of interest to botanists, may now be briefly noticed. In the nineteenth report of the New Jersey station B. D. Halsted (pp. 289–370, *12 pl.*) fills eighty pages with the results of a wealth of observation and experiment, supplemented with a dozen well printed plates. Lime is found to be effective in checking club-root (Plasmodiophora) of turnips, and sulfur ineffective; the latter, however, when applied to the soil outranked corrosive sublimate in reducing the scab of potatoes, and it is even more serviceable in case of sweet potatoes. The fungicides, Bordeaux mixture, cupram, soda-Bordeaux, and creolin, were used with varying results upon beans for *Colletotrichum lagenarium* Pass. and *Bacillus Phaseoli* Sm., on tomatoes for *Cladosporium fulvum* Cke., on spinach for a Cladosporium and a Phyllosticta, on egg-plants for *Phyllosticta hortorum* Speg., on cucumbers for *Colletotrichum lagenarium* Pass., and on beets for *Cercospora beticola* Sacc. Fungicides were also used on other plants with less conspicuous results. The smut of onions, *Urocystis Cepulæ* Fr., was introduced into a plat by bringing soil from another part of the state which had borne a smutted crop the year previous. There are observations upon asparagus rust, and on other parasitic fungi, on shading plants, on weeds, and on a number of other topics. The report closes with a discussion of the relation of fungi to weather.

In the eleventh report of the Hatch experiment station of Massachusetts, George E. Stone and R. E. Smith (pp. 142–167) record observations upon the occurrence and injury of Alternaria on muskmelon, rust on chrysanthemum, *Colletotrichum Violæ-tricoloris* on pansies, and of other parasitic fungi. Rather more space is given to physiological disorders of lilies, roses, cucumbers, and shade trees, being chiefly due to over feeding and to gas poisoning.

In the twenty-second report of the Connecticut station W. C. Sturgis (pp. 225–267) discusses the appearance and prevention of three melon diseases: wilt caused by *Bacillus tracheiphilus*, blight caused by *Alternaria Brassicæ*, and burn due to a sudden disturbance of equilibrium between water absorption and evaporation; of the mildew of lima beans and of the calico and spot diseases of tobacco. There are also seven pages of miscellaneous notes on plant diseases and spraying. In the same report E. H. Jenkins (pp. 310–316) gives statistics on the germination of garden seeds of various ages.

In the fourteenth report of the Maine station L. H. Merrill (pp. 64–74, *7 pl.*) reports in an interesting way upon box experiments with phosphoric acid from different sources. In the same report F. L. Harvey (pp. 131–135) has brief notes on weeds. Also W. M. Munson describes "The blueberry in Maine" (pp. 164–172, *2 pl.*), including four species, *Vaccinium Pennsylvanicum* Lam., *V. vacillans* Sol., *V. nigrum* Britt., and *V. Canadense* Rich., with notes on their culture; he reports experiments on "The acquisition of atmospheric nitrogen and soil inoculation" (pp. 208–212), and he has also a carefully prepared article on the behavior of pollen during fertilization and its after effects in formation of the fruit (pp. 219–229, *5 pl.*), which was in part presented before the Society for the Promotion of Agricultural Science at the Boston meeting in 1898. In the same report W. M. Munson and L. J. Shepard record experiments showing great superiority of crop from large seeds over small seeds of radish (pp. 158–160), and the conspicuous advantages of sub-watering over surface watering in growing radishes under glass (pp. 161–163. *1 pl.*).

In the eleventh report of the Rhode Island station Fred. W. Card (pp. 106–110, *7 pl.*) records the first season's results with apple trees having roots and branches pruned in various ways at time of planting. In the same report H. J. Wheeler and J. A. Tillinghast (pp. 122–191, *19 pl.*) give an interesting and instructive account of varied plat experiments in feeding plants and the use of "nitragin." In the same report J. A. Tillinghast (pp. 192–203) shows by statistics the effectiveness of the hot-water treatment of oats for smut, and the less value of the commercial "ceres pulver."—J. C. A.

BULLETINS from the experiment stations on medicinal and poisonous plants are as follows: C. W. Hyams (N. C. no. 150: 329–409) gives a list of over 800 species of wild plants of North Carolina having reputed medicinal virtues. They are arranged systematically under the Latin names, their poisonous or useful properties noted, and an index appended. It is a useful publication. B. D. Halsted (N. J. no. 135: 3–28, *4 pl. 2 figs.*) gives an account of the plants of New Jersey which are poisonous and liable to be eaten by men or animals, or are poisonous to the touch. It embraces much detailed and useful information. F. W. Morse and C. D. Howard (N. H. no. 56: 111–123, *6 figs.*) have investigated the "Poisonous properties of wild cherry leaves," testing the black cherry (*Prunus serotina*), choke cherry (*P. Virginiana*), and the red cherry (*P. Pennsylvanica*). All were found to be decidedly poisonous, the black cherry especially so. The youngest and most succulent leaves contain the most poison, which is increased somewhat by wilting, and partially lost by drying. The bulletin is an important contribution to our knowledge of the wild cherries. E. V. Wilcox (Mont. no. 15: 37–51, *3 pl.*) reports upon the poisoning of sheep by eating larkspur (*Delphinium Menziesii*), both unintentionally while grazing and experimentally by use of a fluid extract.—J. C. A.

MISS MARIA DAWSON has studied the tubercle organism and the mode of infection in *Vicia hirsuta* and *Pisum sativum*.[12] Her results confirm those of previous observers as to the mode of infection by tubes traversing one or more root hairs into the cortex. These tubes have the advancing end open and consist of numbers of straight rodlets with longer axes arallel to the line of growth of the tube. Finally, after traversing a cell, the tube bursts on one side and sets free the rodlets in the cell cavity. (No such infection tubes were found in Lupinus and Phaseolus.) The matrix enclosing the rodlets contains nothing of the nature of cellulose or chitin, or (probably) mucilage. These characters are conclusive against the organism being one of the true fungi, and call to mind Prazmowski's view that it is a filamentous zoogloœa form of a schizomycete, and also Thaxter's Myxobacteriaceæ. Drop-culture experiments, the first of the kind, enabled the author to follow the multiplication of the rodlets by constriction and separation, the process being completed in 2–4 hours. Bacteroids were also developed in these cultures, but the author has not yet been able to observe the process of their development. Experiments were also made with "nitragin," which showed that it contained the tubercle organism and induced tubercle formation by direct application to seeds or through the soil.—C. R. B.

IN THE *Journal* of the Cincinnati Society of Natural History (**19**: 147–166. 4 Jan. 1900) Dr. A. P. Morgan publishes his fifth paper on the Myxomycetes of the Miami valley, Ohio, in which he presents various systems of classification of this group, some of them of only historical interest. The paper closes with his own grouping of the genera of North America, under four sections, with analytic keys to the genera.—C. R. B.

NO DOUBT students of histology will be interested in hearing how, according to the editor of *Meehan's Monthly*, trees increase in diameter. Explaining how a label was overgrown instead of being pushed outward he writes: "To those who understand the manner in which new wood forms, the explanation is simple. The increase in the girth of trees takes place during a few weeks at midsummer, and is by the rapid multiplication of minute cells. These, at first, are as soft as mush, and might be compared to the flow of so much yeast. If the flow is checked in one direction, it turns to the direction its neighbor is journeying, and adds itself to the volume of that stream." The persistence of erroneous ideas is amazing.—C. R. B.

STUDENTS of grasses will hardly look for articles on that group in the *Revue Bryologique*. Yet the opening number for 1900 contains two by N. Orzeszko of Nice; one on the processes for securing good sections of dried leaves of grasses, *i. e.*, for histological study of herbarium material, and a second consisting of an elaborate code of signs for histological description of

[12] Phil. Trans. Roy. Soc. London B. **192**: 1–28. 1899.

grass leaves. The former may be of some service; such schemes as the latter embodies are useful enough for the note book, but only cumber literature.—C. R. B.

OUR KNOWLEDGE of the life history of the Gnetaceæ has been considerably increased by Lotsy's[13] recent work on the life history of Gnetum. The difficulty in procuring material is responsible for the fact that comparatively few observations have been made. Of the three genera which compose the group, Welwitschia is found only in Damaraland, Ephedra is a desert plant, and the remaining genus, Gnetum, is found only in the tropics. Moreover, as in case of most gymnosperms, the collecting must extend over a considerable period in order to insure anything like a complete series of stages.

Dr. Lotsy's stay at the Buitenzorg botanical gardens in Java enabled him to secure a very complete series of stages in the development of *Gnetum gnemon*, from the earliest appearance of the flowers up to the formation of the embryo.

The inflorescences of *Gnetum gnemon* are spikes which come from the axils of opposite bracts. On each spike is a series of cups which owe their origin to a concrescence of bracts. At the base of each cup is a ring of tissue, upon the upper part of which may be seen a number of small, cone-shaped, greenish bodies; these are the female flowers. The mature female flower has three envelopes, which are formed in acropetal succession. The rudimentary female flowers found on the staminate spikes have only two envelopes.

The author regards the outer envelopes as whorls of bracts, which, for convenience, may be called the internal and external perianths. The inner envelope, which is longer and projects above the other two, he regards as an integument.

At the period of pollination a drop of fluid appears at the top of the integument, and consequently the term integumental stigma is applied. Pollination is probably effected by the wind, though it may be that insects have some part in it.

There is a pollen chamber at the top of the nucellus, formed by the degeneration of cells in that region. Before reaching the embryo-sac the pollen tube contains a tube nucleus and two generative nuclei. The details of spermatogenesis are reserved for a future paper. Each nucellus contains several macrospores which originate as in well-known gymnosperms. The early divisions in the macrospore do not seem to differ from those in Pinus or other familiar forms, there being first a series of nuclear divisions, so that a large number of nuclei lie free in the protoplasmic lining of the embryo-sac. The history from this stage differs from that of other gymnosperms. A constriction appears somewhat below the middle of the sac, reducing the lumen

[13] LOTSY, J.: Contributions to the life history of the genus Gnetum. Ann. du Jardin Bot. de Buitenzorg. II. 1: 46–114. *pl. 2–11.* 1899.

at this point, but by no means separating the upper and lower portions. Walls now appear in the lower portion so that it becomes filled with solid tissue at the apex of which bodies which may be rudimentary archegonia are sometimes found. In the upper portion the nuclei remain free in the protoplasmic lining of the sac.

At this stage, one or more pollen tubes enter, each bringing in two generative nuclei. Each generative nucleus fuses with one of the free nuclei in the sac, and the several copulation products become surrounded by denser protoplasm and soon acquire a membrane. They are now called zygotes. The zygotes germinate into long tubes, which grow down toward the base of the sac and penetrate the solid tissue there. Previous to this time this prothallial tissue has been increasing enormously and in the mature seed the fertile portion of the sac appears as a mere speck at the apex of it. At this stage the seed falls from the plant.

The development of the embryo from the tube which arises from the zygote has already been described by Bower.

The author suggests the following homology with the structures of the angiosperm sac.

Angiosperms		Morphological nature		Gnetum gnemon.
Egg apparatus	=	Archegonia	=	Fertile nuclei.
Micropylar polar nucleus	=	Prothallium	=	Sterile nuclei of upper part of sac.
Chalazal polar nucleus	=	Prothallium	=	Prothallium in lower part of sac.
Antipodals	=	Rudimentary archegonia	=	Rudimentary archegonia on lower part of sac.
Endosperm	=	Prothallium	=	Growing prothallium of lower part of sac.

The conclusion is reached that the Gnetaceæ are very ancient in origin and that they must have originated before or at the same time with gymnosperms (by this probably meaning the Coniferæ.)

He is inclined to regard "the Gnetaceæ as the equivalent of the gymnosperms and angiosperms combined and running parallel to these, having originated entirely independently of them. In these two parallel rows the gymnosperms may be compared to the Ephedroideæ and the angiosperms to the Gnetoideæ."

There will be objections to this interpretation if current views as to the geological history of the group are well founded.—CHARLES J. CHAMBERLAIN.

DATA bearing on the problem of the sexuality of the lichens are gradually accumulating, and the most recent contribution is by Darbishire[14] on *Physcia*

[14] DARBISHIRE: Ueber die Apothecienent wickelung der Flechte *Physcia pulverulenta* (Schreb.) Nyl. Jahrb. f. wiss. bot. **34**: 329. 1899.

pulverulenta. His investigations extend and support the results of Baur (1898). It will be remembered that Baur found again the trichogynes discovered by Stahl in members of the Collemaceæ, observed the sperms fused with their tips, and saw stages indicating that the trichogyne withered from above downward after fertilization.

Darbishire finds the archicarps each with its trichogyne in the youngest portions of the lichen thallus, and so very numerous that 700–1200 may be present on a small lobe. The lower part of the archicarp is an hypha of two or three loose coils, and is situated below the layer of algal cells about midway between the upper and lower surface of the thallus. The multicellular trichogyne extends as a filament between the algal elements to the exterior, where it projects above the upper surface. Sperms were observed attached to the tips of the trichogynes, but older stages show only one fused with each structure. When an archicarp of the group is fertilized it immediately develops rapidly, and, although others may show signs of fertilization and apparently start to develop, they finally disappear, and only one apothecium is formed.

After fertilization some of the large cells in the middle region of the coiled archicarp enlarge and finally fuse, so that there results a swollen multinucleate cell, the ascogonium, in each lobe of which lies a nucleus. A system of much branched hyphæ arises from the ascogonium, becoming the ascogenic hyphæ, from which the asci arise. The paraphyses develop from sterile hyphæ around, but entirely distinct from the ascogenic ones; the two systems of hyphæ being readily distinguishable. The further development of the apothecium follows closely the older accounts.

This investigation supports at all essential points the studies of Baur, and extends the evidence of sexuality to another family of lichens. It suggests the probability of the presence of trichogynes and the sexual act in many more groups than most botanists have been willing to admit in the past. In passing we should also note that the recent suggestion of Lindau in respect to the function of trichogynes appears very dubious. He has presented (1899) a theory that the trichogynes are organs whose function is to bore through the layer of algal elements to the surface of the lichen, thereby weakening this layer and allowing the apothecium to develop more readily and to push up from below. Darbishire shows that such a function for the trichogynes of *Physcia pulverulenta* is quite impossible, and that this operation is performed by the developing paraphyses.

We should bear in mind that whatever are the probabilities of sexuality among the lichens, we have not the knowledge that may be regarded as proof positive. We do not know the fate of the nucleus from the sperm, whether or where the fusion of sexual nuclei takes place, and withal we have a complexity of conditions in the multicellular trichogyne that is certainly very puzzling.—B. M. DAVIS.

A VERY clear paper by Dr. A. Nabokich, on the functions of aerial roots of orchids has appeared in *Botanisches Centralblatt* 80: 331 *et seq.*, 1899. He shows that the supposed power of their velamen to condense water vapor from the atmosphere does not exist, and presents good evidence that these roots can make use of dew only as it condenses on leaves and stems and reaches them in drops. He proves that though they supply the plant with water, there is no correlation between transpiration and absorption, where there is storage of water. Absorption decreases with the temperature of the water, and when the storage factor was eliminated by the saturation of the tissue, there was little or no absorption in cold water if transpiration was prevented. He recognizes no relation between the presence of leaves with water storage and the presence or absence of velamen. The chief function of the velamen, he considers to be the protection of the parenchyma from sudden cooling at night, especially in the dry season, and in support of this view he lists nearly three hundred species showing the relation between the presence of velamen and the environment of the species. Those in moist, equable regions show at most only a few layers of the velamen, while those living under more variable conditions have from a few to eighteen layers. A second function of the velamen is the power of adapting the roots to hydrophytic conditions during the rainy season, when they are encased in water, and he believes the "white streaks" to be air reservoirs to allow them to breathe at this time.—L. M. SNOW.

UNDER THE title "The sexuality of the fungi," Harold Wager presents[15] a summary of the present knowledge regarding nuclear fusions in the fungi, and considers the leading interpretations which have been given to the facts. Wager regards it as possible that in Sphærotheca and similar forms the development of the ascogonial filament of cells exhausts the energy imparted by the preceding fusion of the antheridial and oogonial nuclei; that the energy necessary to produce another reproductive cell, the ascus, can only be obtained by a further nuclear fusion; and that in the higher Ascomycetes this second nuclear fusion has probably replaced altogether the morphologically sexual fusion of the simpler forms. This hypothesis may be extended to embrace the Ustilaginales and Uredinales.

It may well be that a deeper insight into sexuality itself and a due consideration of the later developments in physiology[16] will lead to views involving less of the idea of an energized nucleus.—F. L. STEVENS.

[15] Annals of Botany 13: 575–597. 1899.

[16] LOEB, JACQUES: Am. Jour. of Phys. 3: 135–138. 1899.